

Abstract

[1086] The present invention provides improved angular aperture schemes for generating shaped beam spots having a desired geometric shape from rectangular, elliptical, and semi-elliptical apertures having one sharp edge. A sharper beam edge can be generated by offsetting the rectangular or elliptical aperture in combination with under or over focus. In the spherical aberration limit, under-focused semi-circle apertures provide a sharp, flat edge. The sharp edge can be made resolute enough for precision milling applications, and at the same time, the spot can be made large enough with enough overall current and current density to efficiently mill away material in either a production or laboratory environment. Depending on the particular beam spot that is desired, combinations of techniques including defocusing, aperture offsetting, and stigmatism adjustment, can be used in both spherical aberration dominant and chromatic aberration dominant environments to achieve a desired beam for a desired application.